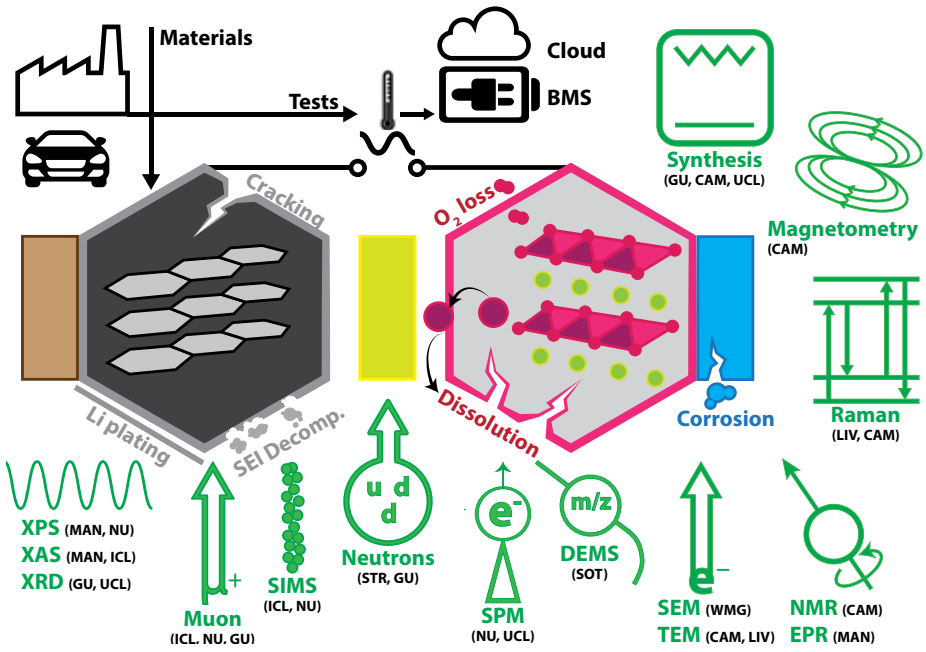
BATTERY DEGRADATION

Led by the University of Cambridge with eight other university and 10 industry partners, this project will examine how environmental and internal battery stresses (such as high temperatures, charging and discharging rates) damage electric vehicle (EV) batteries over time.

Results will include the optimisation of battery materials and cells to extend battery life (and hence EV range), reduce battery costs, and enhance battery safety. With Cambridge, university partners include University College London, Newcastle University, Imperial College London, University of Sheffield, University of Manchester, University of Southampton, University of Liverpool and University of Warwick.

Despite the recent reduction in cost of lithium ion batteries driven by mass manufacture, the widespread adoption of battery electrical vehicles is still hindered by cost and durability; battery lifetimes still fall below consumer expectation for applications requiring high durability, such as transport.

Additionally, fast charging of battery electric vehicles is crucial to help assuage range anxiety and provide the operational convenience required for mass adoption of the technology. Inappropriate fast charging, however, can rapidly accelerate degradation and even trigger degradation mechanisms that are not present in 'normal' operating conditions. A key goal for the automotive industry is to better understand the causes and mechanisms of degradation to enable improved prediction and control of the state of health of battery systems.



ABOVE: The many possible causes of performance degradation in lithium ion batteries and the comprehensive suite of techniques being used to unravel their mechanisms.

Degradation mechanisms can occur on length-scales from the nano to the macroscopic, and timescales from seconds up to years; a full understanding of the causes and effects of degradation of lithium ion batteries for automotive applications therefore requires synergistic investigation across these length and time scales and with the combination of many experimental techniques. A cross-disciplinary consortium of researchers and industry partners has been created with the goal to develop a comprehensive mechanistic understanding of the relationship between external stimuli (such as temperature and cycling rate) and the physical and chemical processes occurring inside the battery that lead to degradation. This project will provide a more complete understanding of the signatures of degradation, lead to increased lifetime and better prediction of failure, and accelerate the development of new battery chemistries through the holistic and coordinated efforts of the research. An ability to fully understand the causes of low lifetime in lithium ion batteries will place the UK at the forefront of the next generation of battery electric vehicle technology.

PRINCIPAL INVESTIGATOR

Professor Clare Grey FRS,
University of Cambridge,
Department of Chemistry
https://www.ch.cam.ac.uk/person/cpg27

PROJECT LEADER

Dr Rhodri Jervis,
Department of Chemical Engineering,
University College London
https://www.ucl.ac.uk/chemeng/people/academic-staff/rhodri-jervis

UNIVERSITY PARTNERS

- University of Cambridge (lead)
- Imperial College London
- Newcastle University
- University College London
- University of Liverpool
- University of Manchester
- University of Southampton
- University of Sheffield
- University of Warwick
- And 10 industrial collaborators